since it is useless to recapitulate examples of the same thing —when my courteous critic and mentor, Sir Charles Cameron, of Dublin, referring to "gravels and boulder clays" (which are earths), calls them "soils," and even goes out of his way to emphasise the kindly lesson he is reading me by a formal record of his belief that "the cleaner the soil we live on the longer we shall live on it."[3] But the soil which I am speaking of is never clean, never has been clean since the globe became populated, and never will be clean till it reverts to the comparative sterility which at one time appears to have largely affected it.

The soil, in fact, according to experiments which have been now uninterruptedly carried on at Woodcote for fourteen years, and which, though still incomplete on one or two points, I consider fully warrant the crude results I am now giving of them, is "soil" in the most ordinary acceptation of the word—organic refuse—that is, animal as well as vegetable, which having lived its life and served its purpose on the outermost confines of the globe, has dropped out of existence, and, in obedience to a law which neither it, or any other material body, is able to resist, is already when we meet with it on its way towards its centre of gravity. Soil, in fact, according to my understanding of it, is *manure—the very medium in which with so much confidence we are making our experiments*—the one great fertilising agent without which the earth would starve, its populations die out, and the atmosphere itself, deprived as it would then be of its means of renewal, and consequently without a purpose, not impossibly also cease to exist.

The earth, on the other hand, properly so called from my point of view, is the very opposite of all this. While the soil is organic, the earth is inorganic. While the soil has its origin on the periphery of the globe, the earth has its origin in its own centre, and its earliest developments in the breaking up and gradual disintegration (by a variety of forces the nature of which being well understood I need not here dwell upon) of its own primitive rocks, till at last they are reduced to the friable matter which we know as "earth." Again, as to the comparative age of the two bodies: while that of the soil can in no case exceed the age of the animal which produces it, or, in the case of vegetables, the duration of the seasonal intervals which mark the rotation of crops, the fall of the leaf, and so forth, the age of the earth is measurable only by the countless ages during which we know it to have been in the course of formation. And yet, again, separated as the two bodies originally are by a space as great as that which separates the poles from the equator, and approaching each other as, in a sense they may be said to do, from opposite ends of the earth, they have, and can have, nothing in common till by a provision of Nature (gravitation?) they are brought into actual contact—a contact differing in nothing, so far as I can see, from that of any two bodies which, being chemically incompatible, give rise on their admixture to a change of their elements, and it may even be to the creation of a new force—such a force, for instance, as has its analogue in the production of the electric spark by the contact of the opposite poles of the voltaic pile. For the interposition of the microbe in changes and metamorphoses of this kind I must confess I can see no necessity whatever, or, in fact, for that of any foreign body, saprophytic, bacterial, or otherwise cryptic and gratuitous.

The physical properties of the soil, again, its weight, its volume, and its extraordinary value as a fertilising agent will, from what has been said of its nature and origin, be readily understood to be measurable only by the whole extent of the earth's surface (which it more or less entirely covers and overlies) and by the amount of organic life, animal as well as vegetable, which is its immediate source of supply. Then as to its weight and the pressure which it exercises on the earth's surface (as to which I shall have more to say later), it is of course that of the atmosphere *plus* its own density, and the weight represented by the pressure which it exercises on the earth as the effect of gravitation. It is, however, its vast extent, its kind, and the irregularity of its distribution which for the purposes of this communication chiefly concern us.

Experiments made in the laboratory have, meanwhile, told us nothing on these points, and herein must be my apology for the noncomformity of my views with those of the eminent men who, taking the microbe for granted and making it the basis of their inquiries, have been generally received as authorities on that part of the subject; the difference between us, however, depending I think solely on the fact that while their investigations have, for the most part, been founded on experiments made within doors, and on the strength of prearranged lines of inquiry, mine have been made wholly out of doors, and on lines suggested simply by what I have met with and seen there during a continuous succession of observations which have engaged much of my attention for twenty-five years, and pretty nearly the whole of it for this last fourteen.

So much for a theory in mere outline, and, as yet, with such proofs only of its stability as may reasonably be read between the lines of the present communication. Nothing will be easier at the proper time than to multiply such proofs, at all events to the extent of largely extending and strengthening the ground on which that assumed stability rests.

On the other hand, points have to be cleared up which, though by no means obscure, require time for their elucidation, and which make me unwilling to go to print with them till I have had that time at my disposal. A single example of such points will suffice to explain this indisposition on my part. Though I have long been aware that nitrification is a more rapid process than I once believed it to be, I had no idea till lately how much more rapid a process it really is; nor, though I have now no doubt of the fact, have I yet been able to arrive at anything like its exact measure.

Again, though I have been making my graves under various conditions as to depth and the contiguity of their contents with the earth enclosing them—beginning with a depth of 4 feet, as that prescribed by the Local Government Board, and ending by simply laying the body on the ground, and covering it with a single foot of earth—my examinations of the whole of these graves have only been made once a year, and the results of such examinations only recorded in print once a year—I now know that if I had examined them every half year or even oftener, I should have found, I will not say the same astonishing results, but evidence of a far more rapid progress towards a return of the body to its elements than I had then believed possible, as well as a more exact knowledge of the rate and kind of change undergone by the body in the interval.

The solution of such a moot point is, of course, of the highest practical importance, and I am led by it and by other considerations to the conclusion that, rather than present it in an imperfect form, I shall do well to let the present paper go to press as it is.

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(To be continued.)

THE MILROY LECTURES
ON
THE INFLUENCE OF THE DWELLING UPON HEALTH.

Delivered before the Royal College of Physicians of London.

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LECTURE I.

[THE particular aspect of the subject of "public health and housing" which the lecturer proposed to take as his subject was, he explained, the relation of the changing style of habitation to the health of the community, especially in regard to the "flat" and allied systems in the metropolis. He proceeded as follows:]

We are becoming more and more town bred, and the stamina, energy, and health of the population must be maintained. From time to time it has been said that the housing question is a simple one, and that the remedy merely requires that the necessary dwelling accommodation should be defined and enforced. Those familiar with the subject recognise that this is begging the whole question, as the dwelling accommodation necessary is the very thing that all deep thinkers and earnest investigators have been endeavouring to find; and the more they inquire into and work upon the subject, the more complex they find are the requirements and the more numerous the points of view from which they have to be regarded, health, construction, economics, and so many other factors governing the question. Statute already provides that every person in a workshop or factory is entitled to 250 cubic feet of air space, and 400 cubic feet during overtime. Although there is no similar statutory definition of overcrowding applicable to dwellings, by-laws provide for at least 300 cubic feet of space per head in common lodging-houses, and 300 or 400 cubic feet in houses let in lodgings or tenement houses when registered. These by-laws also provide for one watercloset for every twelve persons (in London this is statutory for all houses), the use of a refuse receptacle, of water, and of drainage. Further, there are by-laws and regulations as to drainage, water supply, and buildings. Without accepting these provisions as ideal, it is evident that legislation has provided some kind of minimum. It is the altered conditions of present-day life that require to be reconsidered, and the standards correspondingly altered so as to rest upon a basis more in consonance with physiological requirements rather than the mere packing together of human beings.

Previous to and during the major part of the Victorian period each dwelling-house was constructed to suit the needs of a particular class of family, the one or two-storeyed cottage for the poorer classes, the six, eight, or ten-roomed house for the middle classes, and mansions for the wealthy. The increased prosperity and the increased flow of population into towns during the later Victorian period led to such a concentration of population, that under the increased pressure cottages and smaller houses became insanitary areas, are fast disappearing, and are being reconstructed in flats; terrace houses are being more and more subdivided and sublet in smaller dwellings, and the largest houses and mansions are being altered in construction or reconstructed for other uses.

My matter divides itself naturally into three portions: (1) The ascertained effects upon health of certain conditions of habitation; (2) construction and misconstruction; and (3) usage and misusage.

THE EFFECTS OF DENSITY OF POPULATION ON HEALTH.

It may be assumed that, beyond a certain point, increasing density of population upon area in the absence of hygienic measures, would result in increasing mortality, and that in proportion to the application of these measures the mortality would diminish. If the population were distributed equally upon the land, measurement over large areas would be more reliable; but when it is mainly exaggerated in large towns this measurement gives the mean of urban and rural conditions.

As illustrative of this demographic method of stating the effects of density upon nations, the following figures may be quoted:

*Density of Population and Mortality in 1886.**

Countries.	Inhabitants per Square Kilometre.	Births per 1,000 Inhabitants.	Deaths per 1,000 Inhabitants.
Norway	6	30.9	16.1
Sweden	11	29.8	16.6
Denmark...	15	30.9	16.1
France	72	23.9	22.5
Germany...	86	37.1	26.2
Italy	105	36.4	28.3
England and Wales (1886) ...	182	32.8	19.5
Lancashire (1886)	247	33.7	21.9

* The foreign density figures are taken from the article upon demography by M. Jacques Bertillon in the *Encyclopédie d'Hygiène* of Dr. Jules Rochard, vol. i, p. 129; the birth-rates and death-rates, and also the English densities from the annual report of the Registrar-General.

The late Dr. Farr[1] estimated that the mortality of districts was nearly as the sixth root of the density of the inhabitants, subsequently amended to slightly over the eighth root. [The table he framed to illustrate his later formula was demonstrated.]

That death-rates are not determined simply by density of population over large areas was shown by Dr. Ogle[2] in a table relating to the decennium 1871-80 [part of which was exhibited], and in which it was also shown that any regular progressive effect of density upon mortality did not become uniform until the population approached accumulation, so as to be measurable by persons per acre rather than per square mile. Pursuing the same subject, Dr. Tatham,[3] in tables relating to the decennium 1881-90 [which were also exhibited], has shown that the relationship of density and mortality is too complex to admit of being expressed by a formula such as Dr. Farr's, that when death-rates corrected for age and sex distribution are used, the mortality appears to increase in more regular progression with increase of density, and that improved sanitation has lowered the ratio of mortality to density.

It is obvious, then, that any formula would require an alteration and progressive increase in the root of the density to measure the mortality and keep pace with the progress of sanitation from decennium to decennium. The tables not only show in relation to density a progressive decrease of mortality both in the more and the less populated districts, but also that in the more populated districts or towns the decrease is relatively greater than in the country. This may be attributed to improved domestic and municipal sanitation, but factory legislation has also contributed its quota, occupation being an important factor in the mortality of adults, and especially male adults.

In the Decennial Supplement to the Fifty-fifth Annual Report of the Registrar-General for the years 1881-90 Dr. Tatham showed that for each age-group the highest death-rate occurred in the industrial, and the lowest in the agricultural districts, London occupying an intermediate position. Of course, in spite of improved conditions of sanitation and occupation, there will always remain the difference between the air of the country and the town. It may be concluded that the statistics extending over large areas and calculated per square mile do not form any standard of the health of individual districts or parts of districts subject to very variable amounts of provision for sanitary requirements, especially land drainage, sewerage, and water supply, and consisting of populations also varying considerably in age, sex, and occupation.

When particular areas of towns are taken the figures become of greater utility, and for the purpose of showing and comparing the effects of density combined with similar insanitary conditions the principal statistical facts with regard to the Boundary Street area, Bethnal Green,[4] and the Churchway area, Somers Town, St. Pancras, are compared in the following table with London as a whole:

	Boundary Street Area.			London.	Churchway Area.			
	Period.	Boundary Street Area.	St. Matthew, Bethnal Green.		Period.	Churchway Area.	Somers Town.	St. Pancras.
Area in acres ...	1889-90	15	755	77,410	1888-90	1⅓	181	2,672
Density per acre ...	,,	373	168	58	,,	446	183	88
Birth-rate per 1,000 population... ...	1887-90	44.6	37.8	30.3	,,	26.8	33.9	30.1
Death-rate under 1 year per 1,000 births	,,	252	159	151	,,	393	172	153
Total death-rate per 1,000 population ...	1888-90	39.3	22.5	18.9	,,	37.4	23.1	19.1
(a) Zymotic death-rate	,,	9.8	3.8	2.6	,,	5.0	3.2	2.5
(b) Tuberculous death-rate	,,	4.4	2.7	2.7	,,	6.7	3.6	2.8
(c) Respiratory death-rate	,,	12.0	3.6	4.0	,,	11.7	5.5	4.1

(a) *Zymotic Diseases.*—Small-pox, measles, scarlet fever, diphtheria, whooping-cough, typhus, enteric and continued fevers, diarrhœa, and cholera.

(b) *Tuberculous Diseases.*—Phthisis, tuberculous meningitis, tabes mesenterica, rickets, scrofula, and other forms of tuberculosis.

(c) *Respiratory Diseases.*—Bronchitis, pneumonia, pleurisy, asthma, lung disease, laryngitis, and non-membranous croup.

An unhealthy or insanitary area embraces certain main objects of consideration—the site, the relationship of the houses to each other, the houses themselves, and the class of inmates. Mere density alone on square space is insufficient to produce all the results seen in the preceding table, as shown by the dense population housed on the areas of some prisons, reformatories, and other public institutions. The same applies to large blocks of artisans' dwellings, which will be considered later on.

In these the relationships of the houses to each other is immensely improved, and the inmates are a picked class.

These comparative figures show that with the increasing density on square space there is an increasing general and special mortality in insanitary areas. The general mortality increases at all ages, but particularly under one year. The special mortality shows the greatest increase amongst infectious diseases, the next greatest amongst tuberculous diseases, and the next amongst respiratory diseases. If all infectious cases be promptly removed to hospital, and disinfection and cleanliness be enforced, the increases tend to take place in the reverse order—the respiratory diseases first, and the infectious diseases third, the tuberculous still remaining second, being largely influenced by pulmonary tuberculosis.

In reference to this aerial influence, Dr. Ogle pointed out[5] that if a series of industries be arranged in the order of the purity of the air breathed, apart from dusty occupations, the order will also be that of the mortality from diseases of the respiratory organs together with phthisis.

This greater proportionate diminution in the phthisis mortality amongst females, the more indoor of the two sexes, is significant of the improvement of dwellings, and more so when it is realised that the greatest diminution has taken place between the ages of 15 and 45 years, the child-bearing and the child-rearing period, when the woman is most indoors.

Upon square space, as we have seen, we may have increasing density due to the crowding of cities with towns, of towns with quarters, of quarters with street blocks, and of street blocks with houses. The proportionate amount of open square space to the covered superficial area of towns and quarters has not received any exact estimation. Density in cubic space deals with street blocks that may be crowded with houses, houses with dwellings, dwellings with rooms, and rooms with persons. The first three are questions of structure, embracing the size and disposition of rooms, dwellings, houses, and street blocks. On the other hand, the crowding of persons into these is a question of usage upon which some statistics are available.

The varying size of houses and the greater variation introduced by the modern "flat" method of construction has destroyed any value that comparative statistics as to the number of persons per house may have possessed. This applies particularly to London and some other large cities, and therefore we must fall back upon old and well-known statistics. That disease depending solely upon personal infection prevails in proportion to the increased number of inmates in a house is demonstrated by certain tables of typhus mortality compiled in Berlin in 1880[6]. We know that pulmonary phthisis is most prevalent in large towns, in the most densely built parts of a town, and in the most densely populated areas of those parts. In dwelling-houses the effects of crowding received the clearest exposition in the army medical reports and inquiries relating to barracks.

[The mortality from phthisis in the British Army was then alluded to so as to show that it depended on overcrowding in barracks.]

Dr. J. B. Russell has shown[7] that a diminution of the size of dwellings tends to correspond with an increase in the mortality, particularly when accompanied by an increase in the number of persons per room, and that the progressive increase of mortality coincides with the progressive increase of the percentage of population living in dwellings of one room.

Dr. Anderson, the Medical Officer of Dundee, found in 1884, in that city that the mortality in dwellings of one room was 21.4 per 1,000, of two rooms 18.8, of three rooms 17.2, and of four rooms and upwards 12.3 per 1,000, and as deaths in workhouses, hospitals, and other institutions were omitted the true death-rate of the smaller dwellings would be relatively higher still, as the general death-rate of Dundee was 20.7 per 1,000.

Dr. J. B. Russell again by detailed inquiry also worked out the mortality from various causes, and the mortality from all causes in three classes of dwellings, small, medium and large, in Glasgow for the year 1885.

Taking the death-rates in the large dwellings as the standard, the death-rate from zymotic diseases was twofold greater in the medium, and fourfold in the small; from lung diseases twofold greater in the medium, and threefold in the small; and from diseases of nutrition in children under 5 years of age (convulsions and other nerve affections, atrophy, wasting, and premature birth), over two-and-a-half-fold greater in medium, and over fivefold greater in small dwellings of one and two rooms.

In dealing with persons per room we have a basis of which the limits are not so wide, and although an international basis cannot be defined, it may be said that in England the limits lie between 600 and 1,400 cubic feet, but mainly between 800 and 1,200, and average perhaps somewhere near a 1,000 cubic feet per room in dwellings of less than five rooms. If one regards as overcrowded the dwellings in which the number of inhabitants exceeds double the number of rooms, the following are the results in different cities of Europe:[8]

City and Date.	Population.	Over-crowded Population.	Percentage Over-crowded.	Mortality of Whole City.
			Per cent.	Per cent.
London (1891) ...	4,211,743	830,182	20	21.4
Paris (1891)	2,424,705	331,976	14	21.6
Berlin (1885)... ...	1,315,387	363,960	28	24.6
Vienna (1890) ...	1,364,548	387,000	28	24.6
Buda-Pesth (1891)...	468,759	348,609	74	28.0
St. Petersburg (1890)	956,226	442,508	46	28.4

It is probable that the greater attention paid to the sanitation of houses in London as compared with Paris may in some measure account for the mortality not exceeding that of Paris, where the overcrowding was less in 1891 than in London at the same census date.

Bearing certain sources of fallacy in mind there is a remarkable coincidence between the gradation of overcrowding and of mortality in the above table, and, omitting the first and the last, this is particularly noticeable in the four great cities of the Continent in which a similarity in the structure of buildings prevails. This is an important point bearing upon one of the disadvantages attending the Continental mode of construction now coming into vogue in London.

Later experience in Glasgow[9] of the effect of room density upon tuberculous diseases is that in each district of the city where the phthisis death-rate exceeds the mean there also the room density is in excess, and concurrently with the rise in the minimum cubic space per adult inmate to 480 cubic feet in 1890, and the increase in the minimum size of rooms by the Building Regulations Act of 1892, and with other factors, the phthisis death-rate is decreasing, but the rate of decrease is greater in districts which have a concurrent decrease in room density.

[Mr. Shirley Murphy's observations on the influence of overcrowding of air space in dwelling rooms in the metropolis in causation of disease were then referred to.]

It is recognised that the most important factor in the spread of pulmonary tuberculosis is predisposition, and predisposition can be acquired as well as be innate, and further that by hygienic measures the acquired predisposition and the innate disposition, and even the communicable entity of the disease itself, can be so controlled as to be kept in abeyance, and even to be permanently subdued. It is further recognised that the conditions under which it may be acquired are residence in impure air, particularly such as is not renewed often enough, crowding of persons together, absence of sunlight, and dampness. In susceptibility to phthisis, the power of resistance appears to be even more important than the power of infection, or in other words, the prevention of loss of vitality or energy is most important.

In cities the average dwelling space of the inhabitants has a closer relationship to their health than any other condition of health which is capable of statistical expression.[10] If we could obtain a classification of only a portion of the population according to the amount of measured cubic space occupied and the ages and causes of mortality, we should perhaps be able to draw more definite and exact conclusions still. Typhus was formerly very prevalent under conditions of gross overcrowding, and not only typhus but other infectious diseases tend to diminish in prevalence with increase of cubic dwelling space. The phthisis death-rate shows a close relationship to density of persons in cubic space, and phthisis appears to stand almost in the same relationship to respiratory pollution as typhoid does to filth pollution. The respiratory diseases, apart from phthisis, are also influenced by impurities of the air, and afford some measure of their effects, just as diarrhœal diseases, apart from typhoid, are regarded as bearing a relationship to impurities of the soil.

EFFECTS UPON HEALTH OF CERTAIN KINDS OF HOUSES AND DWELLINGS.

The effects of insufficiently separating street blocks from each other—that is, of allowing streets to be made too narrow, displays itself as one of the causes of unhealthiness of insanitary areas. Street blocks contain various kinds of buildings for commercial and for residential purposes, and some types of the houses and dwellings have been subjected to statistical inquiry—for instance, back-to-back houses, stable dwellings, tenement houses, cellar dwellings, and "flat" houses.

The results of statistical inquiries into the effects of back-to-back houses, as constructed in the North of England, agree in the main. The first statistics published were those of certain districts of Salford from 1879 to 1883 by Dr. Tatham, and they showed that parallel with the increase in the proportion of back-to-back houses in the groups selected, the death-rates from all causes, pulmonary diseases, phthisis, and the principal zymotic diseases, and diarrhœa, taken separately, also progressively increased. Dr. Niven later on confirmed these conclusions by statistics relating to the Old Township of Manchester from 1891 to 1894, and found further with regard to age, that in infancy and in advanced years there was also an excess of mortality in the back-to-back houses.

The careful statistics of Dr. Herbert Jones from 1887 to 1892 comparing "through" houses in Saltaire with back-to-back houses in Shipley, showed that in the latter the mortality per 1,000 from all causes were over one-third greater than in the former, from lung diseases nearly one-half greater, from zymotic diseases over one-half greater, and from diarrhœa alone over two-thirds greater.

[Detailed statistics of these inquiries and of some made by Mr. Arnold Evans were given at this point.]

There are certain insanitary conditions that attract attention in mews. The houses are usually constructed in two stories, with stables at the ground level and dwellings over, and like back-to-back houses, have only one front, the other three sides being generally without windows or doors, and without back or side yards. The dwellings are frequently more or less open to the stables below. Beneath the dwelling rooms are horses with their litter and manure, drain gulleys (although these are generally properly trapped), and often w.c.'s under the stairs, sometimes unventilated. These conditions would incline one to expect that the mortality would indicate marked excess in the same causes of death as has been shown by observers in the case of back-to-back houses. And the more so because the roadways of the larger mews, formerly maintained by the owners, have been gradually left to the maintenance of public authorities, a course leading to the prohibition of placing manure and domestic refuse outside the stable-house on what has become public way, and tending towards its retention under the dwelling rooms.

In 1891 an inspection was made of the mews and stables in St. Pancras, and from the notes then made I have been able, by means of careful compilation and revision, to obtain comparable returns of these premises. In conjunction with the census returns, it has been possible to compare the population under 10 years and 10 years and over living (1) in stable dwellings, (2) in the whole of St. Pancras, and (3) the whole of London. The deaths—corrected for public institutions—for the three years 1890-91-92 were also extracted, and these also are comparable with the returns of St. Pancras and of London for the same three years. With the kind assistance of Mr. S. M. Kaka, D.P.H., M.O.H. Karachi, and of the Superintendent Registrar of St. Pancras, Mr. J. Stevens, I have been able to prepare a series of tables giving the following results: In the stable dwellings 34.9 per cent. of the population is under 10 years of age, compared with 21.6 per cent. in all St. Pancras and 22.7 in all London. The birth-rate is half as high again over stables as in the whole of St. Pancras and London, but it is possible that this proportion is slightly exaggerated. The death-rate of infants under 1 year per 1,000 births stands at 193 in stable dwellings as compared with 160 in St. Pancras and 157 in London. The main causes of infantile deaths in stable dwellings are suffocation, bronchitis, pneumonia, measles, whooping-cough, and diarrhœa. The total infantile mortality in stable dwellings from these causes is nearly double that of St. Pancras and of London.

The death-rate of infants under 1 year per 1,000 of total population at all ages was in stable dwellings 9.04, in St. Pancras 4.80, and in London 4.92, again showing a heavy infantile mortality.

The death-rate under 10 years of age in London is 38.7 per 1,000 of population under 10 years, and 1 per 1,000 higher in St. Pancras, and 2.3 per 1,000 higher in stable dwellings. Over 10 years of age per 1,000 of population the mortality in London is 15.5, 1.6 higher in St. Pancras, and 4.6 higher in stable dwellings.

In comparing stable dwellings with back-to-back houses, back-to-back houses show an excess in mortality from all causes—from pulmonary diseases, from phthisis, from the principal zymotic diseases, and from diarrhœa, taken separately. Stable dwellings show an excess of mortality from the same causes, but not in the same proportion.

The death-rate at all ages in the stable dwellings is 5.4 above that of St. Pancras, and 7.4, or nearly one-third more, above that of London. That this is not mainly due to the high infantile mortality is seen from the fact that whereas the mortality under 10 years of age is 2.3 above that of London, the mortality of 10 and over is 4.6 above that of London per 1,000 of population living between the two respective age periods. The death-rate at all ages from the "principal zymotic diseases" is the same in St. Pancras and London—namely, 2.69 per 1,000, but stable dwellings show a rate of 2.12 higher—namely, 4.81 per 1,000. The diarrhœa death-rate, which appears as 0.62 per 1,000 in London, and 0.53 in St. Pancras, is three times as high in stable dwellings—namely, 1.66 per 1,000 population. Tuberculous diseases are 0.23 higher in St. Pancras than in London, and 0.20 higher in stable dwellings than in St. Pancras, phthisis 0.20 and 0.11 higher per 1,000 of population. One might expect higher results in back-to-back type of houses.

Respiratory diseases show a high death-rate (8.17) over stables compared with 5,25 in St. Pancras, and 4.93 in London. The rate is 3.24 higher than in London, but bronchitis and pneumonia alone show a still higher rate, approaching twice that of London.

That the high rate in stable dwellings is not due solely to occupation is shown by the high mortality from bronchitis and pneumonia amongst the home-dwelling infants. This is not due to poverty, as cabmen and carmen are not indigent as a class, the families of even the poorer are fairly cared for in food and clothing, and the better off are well fed and well clothed. In stable dwellings there is an excessive mortality from pulmonary diseases and in infantile mortality, and a lesser excess from phthisis. The probability appears that the vicissitudes of temperature in the occupations of the adults and the construction of the homes of the infants in stable dwellings are prominent factors in the causes of mortality. Some stables are draughty during cleaning time when the stable doors and loft doors are open. Some stable roofs have no ceilings below to equalise the temperature; some also have skylights over the back dwelling rooms, although seldom open, and there are air bricks in the back walls of some stables, yet they show a high zymotic death-rate. They have very high death-rates from diarrhœa and diphtheria, and high from whooping-cough, even when a number of unhealthy conditions are absent, since stables have no underground rooms or cellars and no ground floors below the level of the street, and there is less liability to the rise of ground air under the dwelling-rooms, and to the dampness of walls of the dwelling-rooms by capillarity. The conclusions to be drawn are that the occupants of stable dwellings have a high birth-rate and a high mortality under 1 year and at all ages, and high death-rates from pulmonary diseases both of infants and adults, and from the zymotic diseases, especially diarrhœa and diphtheria. These point to the effects of the vicissitudes of temperature affecting adults, and unhealthy conditions at home affecting young children.

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PAINLESS CALCULOUS PYONEPHROSIS WITHOUT FEVER: NEPHRECTOMY: RECOVERY.*

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PAINLESS calculous pyonephrosis is by no means unknown. Still I find that we are too often induced, when making a diagnosis in a case of painless enlarged kidney, to exclude calculous pyonephrosis on the ground that that disease must always be more or less painful. For that reason I bring forward this case, also remarkable for the absence of any distinct history of fever, although there was much suppuration. I should like to hear the experience of others concerning absence of pain and fever in kidney disease of this type.

A woman, aged 38, was admitted into the Samaritan Hospital early this autumn under the care of Dr. Amand Routh, who diagnosed an enlargement of the right kidney of uncertain nature, and transferred her to me for surgical treatment. She had been married for fifteen years, and had borne eight children; the youngest was $5\frac{1}{2}$ years old. The patient informed me that she had been under treatment some months ago for disease of the womb, but had noticed a swelling in the right side for a year. Whenever she put on her corset she felt much nausea, and the swelling in the right side ached a little. After swallowing food epigastric pain and nausea followed, but when undressed she was always comfortable. She had never passed blood in the urine, and never suffered from symptoms of renal colic; nor could she remember any feverishness or rigors. She had been subject for three or four years to a cold numb feeling in the right arm and fingers; it lasted for several hours, and made the fingers look dead; the feeling ran down the right side, and both feet felt cold. For the last twelve months these attacks came on every day.

I could not get a complete clinical history of the case till some time after the operation, when her former attendant, Dr. Aurelius Maybury of Portsmouth, kindly sent me some notes. He reported that some years ago he treated the patient's husband for double stricture, cystitis, and, he believed, greatly dilated ureter on the right side. Catheterism was still necessary, and pus always came away with the first drops. A few months before my patient entered the hospital Dr. Maybury treated her for copious muco-purulent discharge from the uterus, which was greatly enlarged. After appropriate treatment this morbid condition disappeared—in fact, I could detect no trace of pelvic disease.

The patient was fairly nourished, cheerful, and quite free from pain except when dressed. The abdominal walls were thin; a large movable kidney lay in the right flank, and could be pushed forwards to midway between the mammary and the middle line. Its surface was bilobulated; fluctuation was obscure. It was not tender.

For a week before operation the temperature never exceeded 98.4°. Menstruation was perfectly regular. The pulse was 84, small and regular. In eight days the urine ranged from 24 to 36 ounces in twenty-four hours, specific gravity 1019 to 1026, colour medium yellow, and clear, except on one day when it was turbid, and on that occasion alone was there a trace of albumen.

I operated with the assistance of Mr. Butler-Smythe, and made a Langenbuch's incision on the right side, exposing the kidney. The liver and gall bladder were healthy. I passed my hand deeply into the abdomen till I could feel the left kidney, slightly enlarged, but of normal consistence and perfectly regular outline.

The right kidney, evidently a cyst, was extracted with the greatest ease after division of the peritoneum external to the colon. The connective tissue and fat were absolutely healthy, and there were no adhesions to the kidney. But the ureter was a thin cord proceeding straight out of the cyst-like kidney, no pelvis being distinguishable. I secured the renal artery and vein and a large suprarenal (?) artery, and divided them. The ureter was dissected up for an inch, transfixed with a safety pin, tied, and divided. Thus the kidney was set free. The wound was closed without drainage; the stump of the ureter was fixed in its lower angle.

During the first week the patient had no rise of temperature, and the urine was of low specific gravity, and generally contained albumen. On the twelfth day the temperature rose to 100.4° in the mouth, and remained high for a fortnight, reaching 103.2° on the twenty-second day, the pulse remaining relatively low (84 to 100). The urine ranged from 29 to 40 ounces in twenty-four hours, its specific gravity from 1008 to 1015; there was generally a trace of albumen, and an excess of phosphates. After giving boric acid internally, the patient's condition greatly improved. At first, during the feverish attack, there was slight tenderness in the right loin, and the left kidney was a little swollen but not tender; there was also evidence of cystitis. The end of the ureter fixed in the wound was trimmed away, being sloughy; a small sinus $1\frac{1}{2}$ in. long, but not discharging, lay in its track. There was no constitutional disturbance, sickness, or œdema during the feverishness, the precise nature of which is not certain. The patient did very well after the third week, and left in good condition, passing daily about 40 ounces of clear golden yellow urine of a low specific gravity (1005 to 1012). There was no swelling or tenderness in either loin. Since returning home she has enjoyed very good health.

Contents of the Kidney.—I will first consider the morbid appearances of the removed kidney. It measured over 6 inches vertically. I laid it open just after the operation, a quantity of greenish yellow pus escaped, of which half a pint was collected. Mr. Shattock reports it as "pure *pus laudabile.* It solidified on heating in a water-bath, and contained the normal number of fatty leucocytes. There was no trace of tubercle." A small rough calculus could be felt moving about in a loculus, which did not empty; a second was fixed in an adjacent loculus. The kidney was sent to the College of Surgeons.

Description of the Specimen.—I examined the specimen with Mr. Shattock in the museum of the College of Surgeons. The upper part was dilated into an almost unilocular cyst, through complete stricture of the ureter at its origin from the pelvis. Indeed, the ureter was reduced to a mere shred when I divided it at the operation, and cannot now be detected. On the renal side no trace of the orifice of the ureter could be distinguished. The lowest calyces were separate from the rest of the kidney, obstructed and dilated; one bulged between the two terminal divisions of the renal vessels, separating them to the extent of over 2 inches. The lowest were blocked by a small rough calculus at the infundibulum, and were dilated into a bilocular cyst holding about 3 drachms of pus. In another loculus, developed from a third dilated calyx, lay, perfectly loose, a fragment of a mulberry calculus, one-third of an inch in diameter. The connective tissue around the two branches of the renal vessels was much condensed by chronic inflammation. Yet there was no sign of inflammation in the fat and other tissues around the kidney. The kidney has been sewn up, so as to appear as it did at the operation, but it has shrunk considerably, so that its main cavity no longer predominates in size over the smaller dilated calices.

The infection was probably gonococcal and therefore ascending. It was clear that the calculus in the lower calices blocked them, hence their dilatation, distinct from the general distension of the kidney. The calculus blocked them so firmly, that when the pus emptied out of the kidney as it was laid open the lower calices remained full.

The cause of the blockage of the ureter at the pelvis and consequent dilatation of the kidney was not evident. The loose calculus may have formerly obstructed the ureter, and then come loose after the obstruction had been made complete by inflammation and contraction of that duct below the stone.

A similar case where the ureter was completely strictured but stones were found loose is preserved in the pathological series at the College Museum (No. 3,539 A). The kidney was removed by Mr. Meredith from a woman, aged 33, and the disease was traced to an accident nearly five years before the operation. There was a clear history of attacks of pain, but, as in my own case, hæmaturia had never been observed. In the museum of St. Bartholomew's Hospital (Series xxviii, No. 2,375 A[1]) is a right hydronephrotic kidney which I removed in 1891. In that case there were no calculi, but the ureter apparently became obstructed by adhesion to an aberrant renal artery. These three specimens show that the ureter may be obstructed very completely by adhesive inflammation in the hilum, quite independently of calculi, which may or may not be present. In other words, we are well aware that other agencies besides calculi may obstruct the ureter, whilst it seems possible (as in Mus. R. C. S., Path. Series, No. 3,539 A) that an obstructing calculus may fall back into the dilated kidney. Hence, when we discover a loose calculus in a cystic kidney, we cannot always be certain that it was or was not the cause of the obstruction which led to the dilatation of that organ.

There are several clinical and surgical features in this case besides the absence of pain and fever which seem to me to deserve a little consideration:

1. It is fortunate that I operated at once, for the suppuration was still confined to the kidney, whilst the fat and connective tissue around remained perfectly healthy. Hence I was enabled to remove the kidney with the greatest ease; there were no adhesions; and I enucleated it without tearing or bursting its wall and spilling pus into the peritoneum. Had the operation been deferred because the tumour seemed

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